

CLAIMS

1. A process for injecting fluids comprising:
sizing an orifice to an accurate fluid flow rate;
combining said orifice with a needle for injecting fluid;
said fluid is a gas.
2. A process for injecting fluids comprising:
a pressurized fluid source;
said pressurized fluid flows through an orifice and needle;
said needle penetrates a permeable solid;
said orifice precisely controls the mass flow of said fluid through said needle during injection;
said fluid is gas.
3. A process for injecting fluids comprising:
a fluid at a fixed source pressure;
said fluid flows through an orifice and needle;
said orifice accurately controls the constant flow of said fluid through said needle at said fixed pressure;
said fluid is gas;
said needles penetrate a permeable solid;
said gas is injected for the purpose of treating said permeable solid.
4. A process for injecting fluids comprising:
fluid flows through an orifice while the orifice size is adjusted;
adjustment of the orifice size stops when the desired flow rate is achieved;
said orifice is used in conjunction with a needle to inject fluid.
5. A process according to any one of claims 1 to 4, wherein said orifice is sized by crimping or removing material from the orifice body to achieve said desired flow rate.
6. A process according to any one of claims 1 to 4, wherein said orifice is sized by increasing or decreasing the orifice size to obtain said desired flow rate.
7. A process according to any one of claims 1 to 4, comprising:

said pressure above the orifice is greater than about 2 times the pressure below the orifice.

8. A process according to any one of claims 1 to 4, further comprising:
said flow through the orifice reaches approximately sonic velocity.
9. A process according to any one of claims 1 to 4, wherein the flow through said orifice increases until the back pressure below the orifice reaches critical pressure; said critical pressure is approximately 0.53 times the pressure above the orifice; said fluid flow reaches sonic speed;
the flow rate of said fluid flowing through said orifice does not change, regardless of back pressure.
10. A process according to any one of claims 1 to 4, further comprising:
said fluid is a gas or a liquid.
11. A process according to any one of claims 1 to 4, further comprising:
said fluid is a gas or a liquid, or a combination gas and liquid as a vapor, or a combination of liquid and solid as a colloid.
12. A process according to any one of claims 2 to 3, wherein said solid is a food.
13. A process according to any one of claims 2 to 3, wherein said solid is meat or fish.
14. A process according to any one of claims 1 to 3, wherein said gas contains any one of carbon monoxide, carbon dioxide, or ozone.
15. A process according to any one of claims 1 to 4 further comprising:
a multiplicity of needles.
16. A process according to any one of claims 1 to 4, wherein said fluid flows at a continuous rate.
17. A process according to any one of claims 1 to 4, wherein said orifice is the internal diameter of the needle.
18. A process according to any one of claims 1 to 4, wherein said orifice is independent of the needle.

19. A process according to any one of claims 1 to 4, wherein said orifice is made using any one of LASER, EDM, drilling, punching, grinding, or other mechanical or non-mechanical means.
20. A process according to any one of claims 1 to 4, wherein the size of said orifice is approximately equivalent to the cross sectional area of a circle with a diameter within a range of .002 inch (.0508 mm) to .006 inch (.153 mm).
21. A process according to any one of claims 1 to 4, wherein the size of said orifice is approximately equivalent to the cross sectional area of a circle with a diameter within a range of .0005 inch (.013 mm) to .01 inch (.254 mm).
22. A process according to any one of claims 1 to 4, wherein the size of said orifice is approximately equivalent to the cross sectional area of a circle with a diameter within a range of .0001 inch (.00254 mm) to .02 inch (.508 mm).
23. A process according to any one of claims 1 to 4, wherein the size of said orifice is approximately equivalent to the cross sectional area of a circle with a diameter less than .0001 inch (.00254 mm) or more than .02 inch (.508 mm).
24. A process according to any one of claims 1 to 4, wherein the volume of said fluid through said needle ranges from 1.0 cc per second to 6.0 cc per second.
25. A process according to any one of claims 1 to 4, wherein the flow rate of said fluid through said needle ranges from .05 cc per second to 16 cc per second.
26. A process according to any one of claims 1 to 4, wherein the flow rate of said fluid through said needle ranges from less than .05 cc per second to greater than 16 cc per second.
27. A process according to any one of claims 1 to 4, wherein fluid pressure is within a range from 50 P.S.I. (3.511 kg/ cm²) to 750 P.S.I. (52.6674 kg/ cm²).
28. A process according to any one of claims 1 to 4, wherein said needle penetration is at a continuous rate during said injection of said fluids;
said continuous rate is between approximately .5 inch per second (12.7 mm/sec.) and approximately 24 inches per second (609.6 mm/ sec.).
29. An apparatus for injecting fluids comprising:
fluid is injected through an orifice and needle;

wherein the size of said orifice is approximately equivalent to the cross sectional area of a circle with a diameter less than .01 inch (.254 mm).

30. A product for injecting fluids comprising:

an orifice and needle;

wherein the size of said orifice is approximately equivalent to the cross sectional area of a circle with a diameter less than .01 inch (.254 mm).

31. A process according to any one of claims 1 to 4, further comprising:

a multiplicity of said needles in a gas manifold with a gas delivery system and hydraulic drive system for injection into said permeable solid.

32. A process according to any one of claims 1 to 4, further comprising:

a means for preventing or removing blockages of needles.